



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

May 8, 2015

Mr. Steven D. Capps  
Vice President  
McGuire Nuclear Station  
Duke Energy Carolinas, LLC  
12700 Hagers Ferry Road  
Huntersville, NC 28078-8985

SUBJECT: MCGUIRE NUCLEAR STATION, UNITS 1 AND 2: REQUEST FOR  
ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT  
REQUEST TO IMPLEMENT A RISK-INFORMED, PERFORMANCE-BASED  
FIRE PROTECTION PROGRAM (TAC NOS. MF2934 AND MF2935)

Dear Mr. Capps:

By letter dated September 26, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13276A126), Duke Energy Carolinas, LLC (Duke) submitted a license amendment request to change its fire protection program to one based on the National Fire Protection Association (NFPA) Standard-805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition.

The U.S. Nuclear Regulatory Commission staff is continuing its review and has determined that additional information is needed in the fire modeling area as discussed in the Enclosure.

Sincerely,

A handwritten signature in cursive script that reads "B. Martin".

Bob Martin, Senior Project Manager  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosure: As stated

cc w/encl: Distribution via Listserv

REQUEST FOR ADDITIONAL INFORMATION  
ADOPTION OF NATIONAL FIRE PROTECTION ASSOCIATION  
STANDARD 805 FOR FIRE PROTECTION  
DUKE ENERGY CAROLINAS, LLC (DUKE)  
MCGUIRE NUCLEAR STATION, UNITS 1 AND 2  
DOCKET NOS. 50-369, 50-370

By letter dated September 26, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13276A126), Duke submitted a license amendment request to change its fire protection program to one based on the National Fire Protection Association Standard-805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," 2001 Edition (NFPA 805). The U.S. Nuclear Regulatory Commission (NRC) staff is continuing its review and has determined that additional information is needed in the fire modeling area as follows.

**Fire Modeling (FM) RAI 01.j.01**

NFPA 805, Section 2.4.3.3, states, in part, that the probabilistic risk assessment (PRA) approach, methods, and data shall be acceptable to the NRC. License Amendment Request (LAR) Section 4.5.1.2, "Fire Model Utilization in the Application," states, in part, that fire modeling was performed as part of the Fire PRA development.

In a letter dated January 26, 2015 (ADAMS Accession No. ML15036A084), the licensee responded to FM RAI 01.j and explained that, to account for fire propagation in cable trays, the vertical zone of influence (ZOI) was extended to the ceiling and that the horizontal ZOI encompasses the 35° angle as discussed in NUREG/CR-6850. The licensee further referred to tests conducted by EPRI and NEI to justify ignoring flame spread over armored cable with a PVC jacket beyond the 35° cone. Subsequently, in its response to FM RAI 02.b the licensee stated that a recent review of FPRA-related cables indicates that approximately 15% are thermoplastic, and that 24% of the total cable population in the plant is thermoplastic.

The EPRI/NEI tests that the licensee refers to involved a cable tray that was located approximately 5 ft. above and to the side of the 350 kW ignition source. In both tests the PVC jacket started to melt and drip to the floor, but did not ignite. The objective of these two tests was to assess the performance of jacketed armored cables located in the hot gas layer (HGL). The results do not apply to cable trays that are located directly above the ignition source.

In light of this observation and the licensee's recent finding that approximately 24% of the cables in the plant are thermoplastic, re-quantify the impact of fire propagation in cable trays and the heat release rate (HRR) contribution from the cables on target damage and plant risk. Where applicable, consider the contribution from non-FPRA cables and non-cable secondary combustibles in the revised ZOI and HGL analyses.

Enclosure

#### **FM RAI 01.k.01**

NFPA 805, Section 2.4.3.3, states, in part, that the PRA approach, methods, and data shall be acceptable to the NRC. LAR Section 4.5.1.2, "Fire Model Utilization in the Application," states, in part, that fire modeling was performed as part of the Fire PRA development.

In a letter dated November 12, 2014 (ADAMS Accession No. ML14328A628), the licensee responded to FM RAI 01.k and stated that location effects on the ZOI of transient fires within 2 ft. of a wall or corner were accounted for by multiplying the HRR by 2 or 4, respectively. In a letter dated January 26, 2015 (ADAMS Accession No. ML15036A084), the licensee revised its response to FM RAI 01.k, in particular the part pertaining to wall and corner effects on the ZOI for transient fires. In the revised response the licensee stated that "The hypothetical transient fuel packages were placed where targets such as cable trays or risers would be impacted. Since the target damage could be achieved by placement of the ignition source away from the wall or corner (i.e., an open location transient fuel package), no further adjustments were applied."

It is stated in Section 11.7.1.6 of NUREG/CR-6850, Volume 2, that "[Transient] ignition sources should be located near areas of the room where critical targets are located, including "pinch-points" where targets from two different safety divisions can be damaged by the same fire." It is not clear from the licensee's revised response that this guidance was followed.

Explain how the licensee ensured that critical targets or pinch-points located close to a wall or corner were identified and considered in the transient fire target damage analysis.

#### **FM RAI 02.b.01**

LAR Section 4.5.1 states, in part, that "In accordance with the guidance in RG 1.205, a Fire PRA model was developed for MNS consistent with the requirements of Part 4 "Requirements for Fires At Power PRA," of the American Society of Mechanical Engineers (ASME) and American Nuclear Society (ANS) combined PRA Standard, ASME/ANS RA-Sa-2009, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Application," ... " ASME/ANS Standard RA-Sa-2009, Part 4, requires damage thresholds be established to support the FPRA.

In a letter dated February 27, 2015 (ADAMS Accession No. ML15083A223), the licensee responded to FM RAI 02.b, and stated that the higher damage thresholds associated with thermoset cables were used based on the assumption that the cables at McGuire Nuclear Station, Units 1 and 2, are predominately constructed with EPR or XLPE (thermoset) insulation, a galvanized steel interlocking armor, and a thin flame retardant polyvinylchloride (PVC) exterior jacket. The licensee further stated that a subsequent review of cable information showed that there is a higher percentage of thermoplastic insulation in the plant than initially considered, that approximately 15% of the roughly 12,000 FPRA-related cables are thermoplastic cables (and approximately 24% of the total plant cable population), and that these thermoplastic FPRA-related cables are relatively evenly distributed throughout the plant with only six fire areas being appreciably above the overall average.

The licensee also identified five conservatisms in the present analysis that may (partly) offset the impact of the presence of thermoplastic cables on the Fire PRA. To quantify this impact the licensee performed a sensitivity analysis and determined that a more thorough evaluation of the thermoplastic cable insulation impact does not result in a risk increase greater than  $1 \text{ E-}06/\text{year}$  for CDF or  $1 \text{ E-}07/\text{year}$  for LERF. Finally, the licensee stated that the thermoplastic cable impact on the risk will be re-evaluated when the results of ongoing NRC/industry research on the severity of cabinet fires will be published. This re-evaluation is an implementation item and will be added to Table S-3 of the LAR.

The sensitivity analysis described in Attachment 2 to the response to FM RAI 02.b appears to assume that cable fires do not propagate in stacks of horizontal trays. In light of the fact that the response to FM RAI 01.j.01 is likely to invalidate this assumption, revise the aforementioned sensitivity analysis taking ignition of and fire propagation in cable trays into account.

#### **FM 02.c.01**

NFPA 805, Section 2.4.3.3, states, in part, that the PRA approach, methods, and data shall be acceptable to the NRC. LAR Section 4.5.1.2, "Fire Model Utilization in the Application," states, in part, that fire modeling was performed as part of the Fire PRA development.

In a letter dated October 13, 2014 (ADAMS Accession No. ML14297A162), the licensee responded to FM RAI 02.c, and subsequently revised the response in a letter dated December 12, 2014 (ADAMS Accession No. ML14365A071). Both the initial and the revised response contain the following statement: "The heat release rate contribution from the small amount of flame-retardant, self-extinguishing jacket material that might collect on the top surface of the ignition surface (e.g., electrical panel) is considered negligible in comparison with the peak HRR of the ignition source and is therefore considered insignificant with respect to the postulated target damage."

The licensee's Design Basis Specification for Fire Protection indicates that approximately 45% of the combustible mass of power cables and 60% of the combustible mass of control cables is outside the armor.

Provide a quantitative assessment to justify the licensee's conjecture that the HRR contribution from the jacket material is negligible and its impact on the postulated target damage is insignificant.

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*/RA/*

Bob Martin, Senior Project Manager  
Plant Licensing Branch II-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-369 and 50-370

Enclosure: As stated

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**ADAMS Accession No. ML15125A328**

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